Route to:

Return to:

INSTITUTE OF GAS TECHNOLOGY
AFFILIATED WITH ILLINOIS INSTITUTE OF TECHNOLOGY
CHICAGO 16, ILLINOIS

GAS ABSTRACTS

VOLUME 5
NUMBER 10

OCTOBER
1949

CONTENTS

1. Gas Industry 229
2. Appliances 232
3. Combustion and Industrial Furnaces 233
4. Carbonization and Gasification 235
5. Natural Gas and Natural Gas Condensates 240
6. Petroleum and Synthetic Liquid Fuels 246
7. Analytical Methods and Tests 249
8. General and Physical Chemistry 251
9. Organic Chemistry 252
10. Chemical Engineering 252
11. Process Equipment and Instrumentation 253
12. Materials of Construction 255
13. New Books 256

GAS ABSTRACTS is published and distributed monthly by the Institute of Gas Technology, Chicago 16, Illinois. The contents of selected papers and patents are reviewed impartially by the editorial staff and material of potential interest to the Gas Industry is presented. Subscription rates to non-members of the Institute: $15.00 per year. — Printed in the U.S.A.

Copyright 1949 by the Institute of Gas Technology.

1. GAS INDUSTRY

Expansion

Forman, W. WHAT'S NEW IN THE GAS INDUSTRY AND WHAT IS YOUR FUTURE? *Gas Age* **104**, 27-28, 66 (1949) *September* 15.

Among the outstanding accomplishments of the gas industry in recent years are the phenomenal expansion of natural gas production and sales, the development of new uses such as gas air conditioning, the expansion of production and utilization research promising even greater accomplishments in the future and, last but far from least, the fostering of very favorable public opinion toward the industry through a combination of superior performance and good publicity. The basic philosophy of the industry, "keeping the pressure on the mains," has won it the trust of the public. The courteous, technically skilled service man has been a key figure in building good will. The combined impact of the service man's personal contacts with the public and of the increased promotional and advertising activities of the industry are building the favorable public relations which insure continued expansion of the industry.

J. C. Lane

EXPANSION PLANS ENLARGED. *Am. Gas Assoc. Monthly* **31**, 7, 51 (1949) *September*.

The gas industry's expansion and modernization plans have been increased during the past year contrary to the trend in most major industries which have either completed or curtailed similar plans. Recently released data estimate the industry's gross construction expenditures for the period 1948-1952 at 3½ billion dollars. Last year's estimate for the same period was 3⅓ billion dollars. Some 770 million dollars were spent in 1948, and it is expected that the 1949 expenditures will exceed 943 million dollars, leaving about 1.8 billion to be spent in the remaining three years of the plan, exclusive of pipe line projects pending Federal Power Commission approval.

J. C. Lane

GAS CONSTRUCTION EXPENDITURES. *Gas Age* **104**, 34, 74, 76 (1949) *August* 18.

A resurvey of the projected construction by gas utility companies during the five year period ending in 1952 indicates an estimated expenditure of 3½ billion dollars. A tabulation presents a breakdown of this sum by type of facilities to be constructed.

J. C. Lane

Financing

INDEX OF YIELDS: SELECTED UTILITIES STOCKS. *Am. Gas J.* **171**, 15 (1949) *August*.

Reductions in the yields obtainable on all groups of utility stocks reflect improved conditions in the stock market. For the first time since 1946, utility managements are considering refunding outstanding bonds with new issues bearing lower interest rates. Economically the gas industry appears more soundly situated than at any time in recent years. However, the trend of prices for gas company stocks may be expected to be affected by what transpires in other segments of the stock market.

J. C. Lane

Heating

Gray, R. COMPETING WITH NATURAL GAS. *Fuel Oil and Oil Heat* **8**, 45-49 (1949) *August*.

Combining the results of nine consumer surveys made during the years 1940-1948, the author found that 44% of American families would prefer to heat their homes with oil, 33% with gas, 18% with coal and 5% with other fuels. However, natural gas is not yet available in many heavily populated areas, so the future competition can not be estimated from those figures. Some 38% of American families apparently have a prejudice against gas for heating. Since only a small percentage prefer coal to gas and oil, this fact leaves an appreciable segment of the population as an almost exclusive market for oil heating unless the gas industry can succeed in winning that segment over by educational advertising and promotion. Competition with natural gas on the Btu per dollar basis or on the basis of cost of equiv-

alent furnaces is difficult for the oil heating group. However, that group hopes that the apparent trend toward higher field prices for natural gas will continue to the point where oil can compete on a cost basis.

J. C. Lane

FUEL OIL—NATURAL GAS COMPETITION FOR HEATING FUEL MARKET SHOWING STEADY GROWTH. *Natl. Petroleum News* **41**, 42 (1949) *September* 7.

Invasion of the established oil-heating areas of New England and the Atlantic Seaboard by natural gas is developing slowly but steadily. The newly formed Northeastern Gas Transmission Company plans to bring natural gas into New England by 1950. A list of the nation's cities of more than 50,000 population intended to be served by natural gas transmission facilities authorized by the Federal Power Commission during the first half of 1949 indicates some invasion of the eastern oil-heating strongholds along with increased supplies to established gas heating areas in the West and Midwest.

J. C. Lane

GAS HOUSE HEATING BAN LIFTED IN MANY AREAS. *Am. Gas Assoc. Monthly* **31**, 21, 51 (1949) *September.*

The lifting of gas house heating restrictions in many areas is expected to add more than 693,000 new customers to the 6,600,000 families now using gas for space or central house heating. A survey by the A.G.A.'s Bureau of Statistics has indicated that approximately 9,350,000 of the 19,750,000 residential gas customers studied are not subject to house heating restrictions and that an additional 1,300,000 will be freed from restrictions before the end of the year.

J. C. Lane

LP-Gas

REGIONAL SALES BREAKDOWN. *Butane Propane News* **11**, 39-49 (1949) *September.*

The national sales of liquefied petroleum gas are broken down into five geographical districts and the percentages and volumes sold in those regional areas are given. These data are further broken down into percentages consumed by various uses in each district. A chart shows separately the quantities of butane, propane and butane-propane mixtures sold in each district. Other valuable statistics suitable for use in a market survey of the liquefied petroleum gas industry are presented.

J. C. Lane

Manufactured Gas Industry

East, L. H. OUTLOOK FOR THE MANUFACTURED GAS INDUSTRY. PART II. RESEARCH AND FINANCIAL ASPECTS. *Gas Age* **104**, 34-36, 60-62 (1949) *August* 4.

The gas industry's research program began with the organization of the Institute of Gas Technology (in 1941) and has been further implemented (since 1944) by the PAR program of the American Gas Association. The research work of the Institute has proved invaluable to the Industry, and its graduate courses in gas technology have developed young men for the industry who are thoroughly trained for technical positions. The value in future years of having such trained men available in the gas industry is beyond estimate. Two recent developments of gas industry research which have reached plant application are the Hall High-Btu Oil Gas Process and the catalytic gasification of hydrocarbons. In the Hall process, high-carbon-residue oils are gasified in the checker work of a water gas set and the deposited carbon is burned with regeneratively heated air to supply heat for the make run. The efficient use of low grade heavy oils makes this process attractive. In the catalytic gasification process, hydrocarbons such as propane or butane are cracked in the presence of steam and air in tubular furnaces containing nickel catalyst. Low Btu carrier gases high in carbon monoxide and hydrogen content are formed, which are then cold enriched with propane or butane to produce peak load gases completely interchangeable with the normal sendout whether natural or manufactured. Large capacity at relatively low investment, low labor costs and lack of contamination of the gas from sulfur compounds are advantages of the process. Research is in progress to extend the applicability of the process to heavier hydrocarbons

such as gasolines, light furnace oils and diesel oils. The use of oxygen-enriched blasts in carburetted water gas sets, the Fischer-Tropsch synthesis, the hydrogenation of coal and underground gasification are a few of the subjects currently under investigation. Utilization research has shown that the products of combustion from a gas range can be employed to remove cooking odors and vaporized greases by the installation of a simple ventilating system. The development of a gas-oil dual fuel burner for central space heating offers the means for reducing peak loads. Increases in the costs of raw materials combined with the inability to obtain compensating rate increases have reduced gas company earnings. When this situation is corrected, the manufactured gas industry, bolstered by the aggressive PAR program and by the research developments and trained men of the Institute of Gas Technology, will enjoy a bright future.

J. C. Lane

Natural Gasoline

NATURAL GASOLINE AND ALLIED PRODUCTS UTILIZED AT REFINERIES IN THE UNITED STATES BY DISTRICT, 1932-1947. *Petroleum Engr.* **21C**, 48 (1949) *September.*

Natural gasoline and allied products utilized at refineries are tabulated by districts for the period of 1932-1947.

J. D. Parent

NATURAL GASOLINE AND ALLIED PRODUCTS PRODUCED IN THE UNITED STATES BY STATES AND BY METHODS OF MANUFACTURES, 1944-1945. *Petroleum Engr.* **21C**, 49 (1949) *September.*

Natural gasoline and allied products are tabulated by states according to method of manufacture for the years of 1944 and 1945.

J. D. Parent

Rates

Rosenthal, R. L. A PRAGMATIC APPROACH TO "REASONABLE RATE OF RETURN." *Gas Age* **104**, 27-30, 64-70 (1949) *August* 18.

A method for calculating the "reasonable rate of return" upon which rates are based is presented. The theory behind the method is that investors, by the prices which they are willing to pay for securities, dictate the rate of return which companies must obtain, both with respect to present operations and to capital expenditures which they plan. That is, market place judgment, not the subjective reasoning of a commission or court however sincere, is the proper basis for determining reasonable rate of return. The method for calculating the required rate of return is illustrated by data for an actual company. This rate varies for each individual company and changes from year to year. Frequent rate changes based upon the economic facts of life of the market place are desirable, since they would permit each company to obtain capital from investors with which to add to its facilities for the following purposes: (1) adequately to serve increasing demand, or (2) promptly to reduce costs by substituting modern, lower-cost equipment for obsolete, uneconomical equipment.

J. C. Lane

Refining Operations

U.S. REFINING OPERATIONS DOWN. *Petroleum Refiner* **28**, 78 (1949) *August.*

On the basis of daily average crude runs to stills, United States refining operations during the first six months of 1949 were 2.5%, or 140,000 bbls per day, lower than during the same period in 1948. The national average per cent of refining capacity in use was 96.5 in June, 1948, and only 82.6 in June, 1949. Lagging demand for most refined products and efforts to avoid accumulation of excessive stocks are cited as reasons for the curtailment.

J. C. Lane

2. APPLIANCES

Air Conditioning

Bain, T.C. PROFITABLE MARKET OPENS IN LARGE CAPACITY AIR CONDITIONING. *Gas Age* **104**, 31-33, 64-65 (1949) *August* 4.

A large capacity (15 to 35 tons) gas-engine driven air-conditioning unit has proved to be more economical to operate in natural gas areas than the equivalent electric motor driven unit. Figures given estimate an annual saving in operating cost of $1100 over the cost of operating two 35 ton electric driven units. Engine speed can be controlled giving better control of the cooling coil temperature. The sale of these units is being promoted by Lone Star Gas Company to obtain a larger market for gas in summer.

E. F. Davis

Burners

Minchin, L.T. FLAT FLAMES AND FLAT JETS—THEIR APPLICATION TO BURNERS FOR TOWN GAS AND HYDROCARBON GASES. *J. Inst. Fuel* (British) **22**, 299-301 (1949) *August.*

The obvious advantage of flat flames is that they provide the largest possible surface area at which gas and air can intermingle. Although flat flame jets are generally employed as non-aerated burners they have been successfully employed with aerated burners with a port loading of 0.02 sq in/cu ft/hr of 500 Btu/cu ft gas. Because of the large surface area greater quantities of gas can be burned in much smaller spaces and with a very short flame. The possibility of employing this fan type jet to entrain air in a rectangular venturi rather than the circular venturi of an atmospheric burner is proposed. A theory for the operation of flat jets is postulated.

E. F. Davis

FLAME MATCHING BURNER. *Gas World* (British) **130**, 1375-1377 (1949) *August* 20.

A pocket size burner is employed by gas service men to obtain a reference flame by which the flame on appliance burners may be compared and adjusted. The ratio of the flame inner cone height to the outer mantle height on the appliance burner is adjusted to the corresponding ratio on the matching burner. This type of adjustment is particularly advantageous where gas composition varies widely. Several modifications have been worked out for special burners.

E. F. Davis

Controls

Eskin, S.G. COMBINATION CONTROLS. *Gas* **25**, 43-47 (1949) *September.*

A review is presented of recent developments in the field of combination controls for automatic domestic heating and cooking appliances, primarily water heaters, ranges, and house heaters—with particular emphasis on controls which perform more than one function, such as acting as shut-off valve and thermostatic control.

Author's abstract

Gauger, F.A. AUTOMATIC IGNITION AND SAFETY CONTROL MEANS FOR GAS BURNERS. U.S. 2,478,386 (1949) August 9.

Four claims are made for an automatic ignition and control system for gas range oven burners. Essentially the system employs flash tube ignition from the range top pilot by utilizing two additional pilots. The flow of gas to the secondary pilots is regulated by thermomagnetic valves from thermopiles. Control of the system is maintained by a combination gas valve and oven thermostat. An electric time clock can be employed in the circuit.

E. F. Davis

Heat Pump

Sandfort, J.F. THERMODYNAMIC CRITERIA FOR HEAT PUMP PERFORMANCE. *Heating, Piping & Air Conditioning* **21**, 105-110 (1949) *September.*

The heat pump is treated here as a steady flow apparatus, and the maximum conceivable coefficient of performance is computed using the concept of availability, irrespective of any particular cycle. A convenient method is thus pro-

vided for analyzing the various ideal gas and vapor compression cycles and determining the degree to which they approach the maximum conceivable coefficient of performance (CP). Emphasis is given to the limitation of the popular single stage vapor compression cycle, and the ideal Carnot cycle.

Author's abstract

Space Heating

Arthur, F.C. MEETING PEAK DAY DEMAND CAUSED BY SPACE HEATING. *Gas Age* **104**, 35-39, 70, 72, 73 (1949) *August.*

By limiting conversions to gas space heating to use of the newly developed gas-oil burner and by lifting all restrictions on new homes and commercial establishments the utility operating in the Kansas City area would only have to curtail the industrial load 240 MMcf of gas or 60% of the total industrial load.

E. F. Davis

Telkes, M. A REVIEW OF SOLAR HOUSE HEATING. *Heating & Ventilating* **46**, 68-74 (1949) *September.*

Various methods of solar house heating are summarized in their relation to the efficiency of collecting and storing the available solar energy.

Author's abstract

Venting

Dean, C.H. APPLYING AVAILABLE RESEARCH FINDINGS WOULD CREATE VENTING STANDARDS. *Am. Gas J.* **171**, 17-18, 42 (1949) *August.*

In this second article of the series, the author discusses the results of the Research Bulletin No. 103 of Purdue University and elaborates on the necessity for nationwide specifications for installation of vented gas appliances to flue and chimneys. The flues and chimneys should not have excessive thermal losses or high frictional resistance and should be of adequate capacity. Attention is called to the fact that negative interior pressures can result in the same unsatisfactory ventilation as the three aforementioned causes.

E. F. Davis

Dean, C.H. BLISSFUL IGNORANCE CAN BE FOLLY IN FLOOR FURNACE VENTING. *Am. Gas J.* **171**, 17-19, 46 (1949) *September.*

Mr. Dean discusses the results of improper venting of floor furnaces, the most common being excess humidity. He points out the correct method has been established by the recent Purdue Research and shows that it is as simple as piping gas or water if a simple analysis is made.

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Annealing

GAS FIRED ANNEALING FURNACE HANDLES RAILROAD TANK CARS. *Iron Age* **164**, 85-86 (1949) *September* 8.

A gas fired furnace 52 ft long, 19 ft wide and 21 ft high, for annealing or stress relieving welded railroad car tanks and other vessels is described. Burner capacity is sufficient to bring the furnace, plus a 75-ton charge, to 1600°F in 3 hrs. Wall and arch design, burner arrangement and controls are discussed.

Editor's summary

Carburizing

Cowan, R.J. CONTINUOUS GAS CARBURIZING. *Steel* **125**, 78-81, 127 (1949) *September* 25.

In this first section of a two part article, the author traces the history of a now firmly established heat-treating process which consists of entering work at one end of a muffle and discharging it at the other end in a carburized condition. One of the early problems was to eliminate the deposition of carbon on the alloy steel muffle. This was done by replacing the alloy steel with brick. It was also found that trays used to convey the work contained shrinkage cavities which tended to deposit a considerable quantity of carbon and later to "cauliflower" or burst open. Cauliflowering was stopped by exercising better control over the manufacture of tray castings. Many other developments in gas carburizing are discussed.

E. F. Davis

Combustion

Arthur, J.R. and Bowring, J.R. THE COMBUSTION OF CARBON: INHIBITION OF SECONDARY REACTIONS BY VOLATILE REAGENTS ADDED TO THE OXIDIZING GAS. *J. Chem. Soc.* (British) 1949, S1-S12, *Supplementary Issue* No. 1.

Inhibiting agents increase the CO/CO_2 ratio in the gases resulting from the combustion of electrode carbon in dry air at 850°C. The inhibiting effect increases with the concentration of the inhibitor up to a threshold value, in all cases less than 1%, and thereafter remains constant. The inhibitors studied and the CO/CO_2 ratios obtained at concentrations exceeding the threshold values are: $POCl_3$, 8.4; PCl_3, 6.4; Cl_2, 2.9; CCl_4, 2.6; $CHCl_3$, 2.3; $SnCl_4$, 2.1; CH_2Cl_2, 1.1; HCl, 1.16; I_2, 0.59; SO_3, 0.52 and without inhibitors 0.05. The inhibiting effect of CCl_4 is destroyed by small additions of H_2O or H_2. These data suggest that the primary product of the combustion of carbon is CO and that CO_2 is produced by a chain reaction which may be suppressed by chain-breaking inhibitors. The promoting effect of H_2O and H_2 suggest that the reaction mechanism leading to CO_2 formation probably involves hydrogen-bearing species.

A. J. Rudnitzki

Lewis, B. and Von Elbe, G. COMBUSTION. *Ind. Eng. Chem.* 41, 1851-1862 (1949) *September.*

The literature appearing in the field of combustion during the latter part of 1947 and most of 1948 is surveyed and briefly abstracted. Of interest to the gas industry are the sections on fundamental investigations on gaseous combustion, fundamentals of carbon combustion, furnaces, smoke abatement, gas burners and prevention and control of fires and explosions.

A. J. Rudnitzki

Dual-Fuel Engine

FOR THE DIESEL OPERATOR: WHAT THE DUAL-FUEL ENGINE CAN DO. *Power Generation* 53, 102, 104, 106, 108 (1949) *August.*

The dual-fuel engine is an engine that operates on all oil fuel on the diesel cycle or on gaseous fuel with oil ignition, being convertible from one to the other. Most of the engines are 4-cycle although some are 2-cycle. When the engine is burning gas a small amount of oil, usually about 5% of the total fuel, is added for ignition of the gas. Cylinder peak pressures and exhaust temperatures with gas operation tend to be a little lower than with oil operation. Gas operation also shows an improvement in smoothness of operation over oil operation. Although most of these engines have been run on natural gas, various other gases such as refinery gas, manufactured gas, sewage gas, and propane have been used successfully. A chart is included showing the relative cost of natural gas versus fuel oil and reveals that even when using gas where it is most expensive it can readily compete with oil. The controls on the dual fuel engine can be so adjusted that when gas supply pressure falls below a value necessary to maintain load and speed, pumps will be started to supply oil in an amount sufficient to offset the gas supply deficiency.

E. J. Pyrcioch

Furnace

Lemaire, E.A. FURNACE PLANT FOR CONSUMING RAW COAL DUST. U.S. 2,479,376 (1949) August 16.

A furnace plant for burning raw coal dust is described, which comprises a regular chain-grate, above which is a combustion chamber with vertical front and side walls. The rear wall of this chamber is sloped at 20° to 40°, and at one third the height of the chamber a slot is provided in this wall through which coal fines are thrust by a screw feeder, the fines sliding down the incline to a zone where they are lifted and burned by rising air-currents. Unburned fines carried through the tube nests are settled and returned via the screw feeder.

O. P. Brysch

Gas Turbines

Barr, J. and Mullins, B.P. COMBUSTION IN VITIATED ATMOSPHERES. I. COMBUSTION PROCESS IN VITIATED AIR. *Fuel* (British) **28**, 181-188 (1949) *August*.

The first paper in this series is a fundamental discussion of the effect of recirculation of combustion products on the significant phases of the combustion process as it occurs in the gas turbine. Physical and chemical properties of the vitiated air are calculated and the effects on stages in the combustion process are inferred.

A. J. Rudnitzki

FIRST WORLDWIDE GAS-TURBINE SURVEY. *Power* **93**, 95-97 (1949) *August*.

A complete summary is given of more than 60 gas-turbine units, ranging in size from 150 hp to 27,000 hp, totalling over 410,000 hp now operating, under construction, and on order. The data reported was obtained from firms active in the gas turbine field and includes such items as rated capacity, operating temperature and pressure, kind of cycle, type of combustor, rated performance, and turbine and compressor characteristics. Thermal efficiencies range from 14.0% for the open cycle to 40% for the free piston cycle.

C. Von Fredersdorff

Glass Manufacture

GAS FIRING IN GLASS MANUFACTURE. *Ceramics* (British) **1**, 300-310 (1949) *August*.

The use of gas in glass manufacturing has greatly simplified many of the old procedures and caused a reduction in operating cost. The flexibility with which this fuel may be employed is said to be responsible for the savings. The use of gas in heating pot furnaces, glass tanks, glory holes, leans and indirect flame annealing is described. A new type of glory hole furnace using a permeable sillimanite lining consumes considerably less gas than the older type and little or no glass "blooming" trouble has been encountered.

E. F. Davis

Space Heating

Wendt, J.S. GAS SPACE HEATERS VERSUS COKE BURNING SALAMANDERS. *Gas Age* **104**, 25-26, 66, 68 (1949) *September* 15.

Counter flow Dravo heaters were used to replace the coke burning salamanders employed in a typical foundry for space heating. It was found that a net annual saving of $402 was possible. In four years, after the new equipment has been amortized the savings will total $4,372/year. Fuel cost of natural gas was given at 42 cents/Mcf.

E. F. Davis

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Brinkley, S. R., Jr. and Lewis, B. COMBUSTION GASES. p. 251.

Potten, A. J. NOTES ON INSTALLATION AND OPERATION OF AUTOMATIC INSTRUMENTS FOR ANALYSIS OF COMBUSTION FLUE-GASES. p. 254.

4. CARBONIZATION AND GASIFICATION

Ammonium Sulfate Production

Bell, J. BY-PRODUCT SULFATE OF AMMONIA PRODUCTION. *Gas World* (British) **130**, *Supplement*, 105-111 (1949) *September* 3.

This article is a general review of the publications of the Research Department of the British Sulphate of Ammonia Federation, Ltd. The recommended materials of construction for saturators are acid-resisting tills for the shell and bottom, and a roof lining of lead homogeneously attached by burning on from rod. A study of the steam consumption of ammonia stills showed that a steam saving of 25% could be achieved by recycling part of the saturator exit gases through the still.

W. E. Ball

Reynolds, D. A. and Wolfson, D. E. COAL CARBONIZATION: AMMONIUM SULFATE YIELDS FROM COALS OF VARIOUS REGIONS OF THE UNITED STATES. U. S. Bureau of Mines Report of Investigations 4526 (1949) August.

The yields of ammonia from 58 coals carbonized by the BM-AGA method are given. Classification by states shows high yields for Washington, Alabama and Utah coals, and low yields for West Virginia coals. The rough correlation of yields with nitrogen and moisture contents is shown. Geological age of the coal was judged to be of secondary importance. The authors conclude that irregularities are due to differences, as yet unknown, in constitution of the coals.

W. E. Ball

Bureau of Mines Report

Fieldner, A.C. and Gottlieb, S. ANNUAL REPORT OF RESEARCH AND TECHNOLOGIC WORK ON COAL: FISCAL YEAR 1948. U. S. Bureau of Mines Information Circular 7518 (1949) August.

The sections of this report which deal with carbonization and gasification are of interest to gas men. Complete BM-AGA *carbonization tests* were made on 2 high-volatile A West Virginia coals, No. 93 Chilton bed, Lorado, Logan County and No. 94 Lower Cedar Grove-Alma A beds Omar Logan County. Similar tests at high temperatures were made on No. 322, Upper Elkhorn bed, Knott County, Ky., and No. 328, Palace No. 5 mine, State of Coahuila, Mexico. Small scale laboratory carbonization tests were made on the above coals and in addition upon Hill bed Alabama, and Lower Banner bed, Ky. Low temperature assays were made on Wyoming high-volatile C coals and on 18 northern Alaska coals. Five blends were carbonized in the new 500 lb slot type, electrically heated oven recently completed at Tuscaloosa, Ala., which features: (1) full 17-inch oven width; (2) Silica brick walls of 4 1/2 inch thickness to match industrial practice; (3) zoned heat control of walls; (4) suspended moveable wall; (5) standard commercial pressure detecting and recording mechanisms; and (6) permissible range of coking pressure up to 12 lb/sq in. *Gasification investigations* were carried on at Grand Forks, N. Dak. and Golden, Colo. stations on lignites and subbituminous coals. High-hydrogen (9:1) water gas from lignite appears useful for direct reduction of iron ore, or, with purification for synthesis gas production for synthetic liquid fuels, chemicals, ammonia or industrial hydrogen. A laboratory scale retort of 5200 lb coal capacity is used to study variables in *underground gasification* of coal. Preparations are in progress on the second field-scale experiment at Gorgas, Ala. A laboratory-scale pilot plant is in operation on production of synthesis gas by *gasification of entrained 200-mesh coal in oxygen* and steam, with studies of heat losses and gas purification. A pilot plant using Royster pebble stoves up to 4000°C is being tested. The demonstration plant at Louisiana, Mo. is under construction. onsiderable study of gas reactions and effect of catalysts in the Fischer-Tropsch and the Bergius reactions is under way.

O. P. Brysch

Chemicals from Coal

Hall, H. E. and Stevens, J. E., Jr. FINE CHEMICALS FROM COAL. *Ind. Eng. Chem.* 41, 1812-1820 (1949) *September.*

Tennessee Products and Chemical Corporation utilizes its coke oven toluene and benzene as raw materials for side-chain chlorination products. Benzotrichloride is produced by reacting toluene with chlorine at 90-180°C in presence of ultraviolet light, purifying by distillation, and hydrolyzing to benzoyl chloride. Benzoic acid is prepared by further hydrolysis, after which the acid may be neutralized to sodium benzoate. Benzyl and benzal chlorides are produced in a similar manner, and hydrolyzed to benzyl alcohol and benzaldehyde. Cinnamic aldehyde is also manufactured by reaction of acetaldehyde with benzaldehyde. Part of the benzene output is converted to benzenehexachloride. Among projected products are benzyl acetate and benzyl benzoate. Flow sheets and materials of construction are given.

W. E. Ball

Coke Sulfur

Eaton, S. E., Hyde, R. W. and Rood, M. H. TRACER TECHNIQUES USED IN STUDY OF COKE SULFUR. *Anal. Chem.* **21**, 1062-1066 (1949) *September.*

The Republic Steel Corporation tracer study of coke sulfur is discussed from the viewpoint of the analyst. Radioactive sulfur (S_{35}) first was converted by hydrothermal reaction at 250°C with ferrous sulfate, sodium sulfide and water into radioactive iron pyrite. About 43% of the sulfur in the iron pyrite came from the radioactive S, the remainder being inactive S from the reagents. X-ray powder pictures indicated that true crystalline pyrite had been formed. 2.3 lb of the radioactive pyrite was mixed first with 300 lb of coal and this was mixed with one 12-ton normal coke-oven charge of Republic coking coal. This charge was sampled and then coked under normal procedure. Hydrogen sulfide was determined on the gas by absorption in ammoniacal cadmium chloride. The resultant coke from the charge was weighed and sampled. Sulfate, pyritic and organic sulfur in the coal were respectively 0.06, 0.45 and 0.55%. In the coke, the sulfur in the forms of calcium sulfide, iron sulfide and carbonaceous sulfur was respectively 0.04, 0.08, and 0.79%. Gas sulfur determined as cadmium sulfide, and coal and coke sulfur determined as barium sulfates, were then reduced, and by evolution into iodine the H_2S was converted to elemental sulfur which was dried and subjected to activity measurements in a Geiger-Muller counter. These were checked against radioactive sulfur standards prepared similarly from the radioactive pyrite and diluted with pure inactive sulfur. The percentage of radioactive sulfur and therefore of pyritic sulfur of the total sulfur in each sample was directly proportional to the activity. Thus from activity measurements of sulfur from the coal, coke and gas, the sulfur originating from the *pyritic S of the coal* was distributed as 66% in the coke and 23% in the gas. From quantitative chemical determinations, the *total sulfur of the coal* was distributed as 70% in the coke and 25% in the gas. By difference, the organic and sulfate sulfur of the coal was distributed as 73% in the coke and 26% in the gas. The experiment shows that pyritic and organic sulfur of coal remain in coke equally well, and that total sulfur of coal must be low to produce low-sulfur coke.

O. P. Brysch

Coking

Pieters, J. A. L. CONTINUOUSLY OPERATING FURNACE FOR THE DISTILLATION OF FUEL. U. S. 2,477,390 (1949) July 26.

A shaft-type continuous furnace is described for the distillation of carbonaceous materials. Distillation heat is furnished by hot combustion gases introduced through several fixed horizontal distributing channels made of refractory brick. Similar channels permit injection of part of the cooled fuel gas into the bed below the distillation zone whereby the descending devolatilized solids are cooled and descend into a number of separate air-cooled quenching compartments which can be emptied intermittently by a rocking valve.

O. P. Brysch

Coking Coal

Mott, R. A. LABORATORY ASSAYS FOR THE SELECTION OF COKING COALS. *Gas World* (British) **130**, *Supplement*, 91-99 (1949) *August* 6.

The author develops further his (and Spooner's) studies of the relationships of the rank to the coking value of coals. To produce the blast furnace coke required in 1951-1952 for the projected one-sixth increase in British steelmaking capacity, rapid methods of assessment of coking value of a wider range of coals are necessary, along the lines which involve the author's correlations of coke quality indexes with total carbon, hydrogen, volatile matter, or calorific value. Linear relationships of the 1½-in. shatter index to the calorific value of coals of different volatile matter are developed. The test for agglutinating value seems to have lost popularity to the B.S. crucible swelling test. Although the latter is also empirical, and subject to error, a coal can be located on a plot of lines of equal swelling power superposed on a carbon-hydrogen plot. There is also a linear relationship between the B.S. crucible swelling

test and the swelling power of coal in the Sheffield coking test, the latter most precise for strongly swelling coals. The Gray-King swelling numbers reported by the Coal Survey also have been found to be closely related to B.S. crucible swelling numbers. By-product assays are also of great importance in selection of coals, and estimates of gas yield, thermal yield and volatile matter composition can be made from the Gray-King assay, Bauer tube-test, JB/VAL assay, and BM-AGA assay. The assays are difficult to standardize, and are better employed to determine causes of differences in yield and calorific value from those expected for the given rank of a coal. Further study of such empirical tests are needed to enable more exact statements of their meaning.

O. P. Brysch

Desulfurization of Coal

Brewer, R. E. and Ghosh, J. H. DESULFURIZATION OF COAL DURING CARBONIZATION WITH ADDED GASES. *Ind. Eng. Chem.* 41, 2044-2053 (1949) *September.*

The desulfurizing effects of ammonia, hydrogen, and nitrogen at 700-875°C were studied by means of tests conducted in a retort containing a 15 gm. sample of coal. In addition to the determination of sulfur in the coal, coke, and tar, the distribution of hydrogen sulfide, mercaptans, thiophenes, carbon disulfide, carbon oxy-sulfide, and residual sulfur in the gas was determined, using methods of Riesz and Hakewill. Ammonia was found to be the most effective gas, followed by hydrogen and nitrogen in that order. The superior performance of ammonia was attributed to the formation of nascent hydrogen resulting from decomposition. Treatment of coal during carbonization decreased the coke sulfur slightly, but significant reduction was obtained only by crushing the coke and re-treating.

W. E. Ball

Distribution

Heath, H. E. F. RELAYING SERVICES WITH COPPER TUBING. *Gas Age* 104, 20 (1949) *September* 1.

A considerable saving in the cost of relaying long service lines has been effected by pulling new copper tubing through old wrought iron lines. A complete description of the method developed and comparative costs are included.

O. T. Bloomer

PIPE JOINTS REPAIRED FROM INSIDE MAIN. *Gas Age* 104, 15-17, 50 (1949) *September* 1.

A leaking 30 in. gas main running under a street was repaired by the internal application of a rubber base compound to the joints. Complete details of the operation are given.

O. T. Bloomer

Gasification

Von Fredersdorff, C. THE CONTINUOUS GASIFICATION OF POWDERED COAL SUSPENSIONS BY AIR-OXYGEN AND AIR-OXYGEN-STEAM MIXTURES. Paper presented at the American Gas Association Production and Chemical Conference, New York, N. Y., May 23-25, 1949.

Gases varying in composition from that of producer to blue water gas were successfully produced from powdered coal suspensions by air-oxygen and air-oxygen-steam blast in a vertical cyclone type high temperature reactor. The operation embodied tangential firing and slagging conditions up to 2900°F to increase the rate of reaction and to remove a large proportion of the coal ash in a fused state from the make gas. The effects of oxygen and steam to coal ratio, and oxygen concentration on the gas calorific value, gas specific gravity, steam decomposition, carbon conversion and thermal efficiency are demonstrated in a series of correlations of these variables. Thermal and volumetric capacities in considerable excess of carburetted water gas practice were obtained at a gas residence time of 0.3 to 0.4 seconds. The effect of pressure and highly superheated steam on the suspension gasification process is to be tested in a larger reactor consisting of an explosion pulverization nozzle, a cyclonizer or attrition chamber in which fine grinding takes place and a reaction chamber in which the powdered coal is gasified in suspension.

Author's abstract

Meter Changing

Rohman, A. METERS CHANGED WITHOUT INTERRUPTING GAS FLOW TO APPLIANCES. *Am. Gas J.* 171, 11-12 (1949) *August.*

Five years of experience has proved the feasibility and practicality of changing outside meter sets without interrupting the flow of gas, thereby avoiding customer contact and speeding operations. This can be accomplished where a plugged tee is available on the house side of the set. This is accomplished by use of a flexible rubber sleeve, made from an innertube, fitted over the plugged tee at one end and the operator's hand at the other. The plug is removed and a center-drilled expandable plug which is connected to a separate gas supply from the truck is fitted in the pipe downstream of the tee. After the meter is changed the reverse procedure is followed and the job is completed.

E. F. Davis

Oxide Purification

Townsend, L. G. SOME ASPECTS OF IRON OXIDE PURIFICATION OF FUEL GASES. *Gas* (British) 3, 621-661 (1949) *April.*

This paper presents detailed experience of purifier operation in a large company over a period of several years. Topics discussed at length include: (a) factors relating to the design and comparison of purifier installation, (b) the Liverpool purifier plant, (c) purification costs, (d) large scale experiments at Liverpool, (e) influence of load factor on purification plant, and (f) carburetted water gas purification. Fundamental conditions assumed in this work were: (1) the slip of ammonia to the purifiers should be in the range 5-10 gr/100 cu ft; (2) the O_2 content of the purified gas should be 0.6-0.8%; (3) the oxide material initially charged to boxes should have a pH of 7.5-8; (4) backward rotation of boxes; and (5) gas entering purifiers substantially free from tar fog. In this work the allowable H_2S concentration was not more than 1.8 ppm by volume and the desired purifier working figure was 0.3 ppm.

H. Hakewill

Abstractor's Note: This paper contains a great deal of useful information and observations on purifier operation, which is presented in such detail that it must be read in its entirety to be fully appreciated, since no abstract could do this article justice.

Pyrolysis of Coal

Prien, C. H. PYROLYSIS OF COAL AND SHALE. *Ind. Eng. Chem.* 41, 1906-1914 (1949) *September.*

The more important papers of the past year concerned with the pyrolysis of coal and oil shale are reviewed. Attention is directed toward the methods and mechanisms of pyrolysis; the raw materials, products and by-products; recent developments in oven and retort equipment; and analytical and testing procedures.

A. J. Rudnitzki

Synthesis Gas

Mayland, B. J. and Hays, G. E. THERMODYNAMIC STUDY OF SYNTHESIS GAS PRODUCTION FROM METHANE. *Chem. Eng. Progress* 45, 452-458 (1949) *July.*

The general thermodynamic equations for the composition at equilibrium of the products of the steam-methane-carbon dioxide reaction and of the methane-oxygen and methane-air reactions have been developed. The former were used to construct charts for determining composition at pressures from 1 to 21.4 atmospheres between 1200°F and 2500°F and hydrogen to carbon monoxide ratios from 1.75 to 2.25 in the absence of free carbon. The applicability of the calculations to the steam-carbon dioxide reforming process is noted. The equilibrium calculations for the adiabatic reactions of methane with oxygen and air cover the same pressure and temperature range. A discussion of the influence of the operating variables and their economic implications is included.

S. Katz

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Brinkley, S. R., Jr. and Lewis, B. COMBUSTION GASES. p. 251

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Absorption Plant

Tuttle, R. B. STANO ABSORPTION PLANT. *Oil Gas J.* **48**, 40-42, 49 (1949) *September* 1.

Stanolind's newly completed Stano absorption plant in Kansas is now being tested, one year after start of construction. It is designed to process 100 MMcf per day, yielding 950 Btu gas and liquid products whose vapor pressure can be easily varied. Process details are given.

J. D. Parent

Compressors

Carlson, R. F. LOST SOLDIER COMPRESSOR PLANT SUPPLIES GAS FOR THREE DIFFERENT OPERATIONS. *Oil Gas J.* **48**, 56, 59, 65 (1949) *September* 1.

A flow sheet is given for Sinclair's four stage Lost Soldier (Wyoming) compressor station. The station furnishes gas for fuel, pressure maintenance and gas lift on oil wells. Wells produced with gas lift show a very high productivity index.

J. D. Parent

Foster, A. L. COMPRESSOR HANDLES GAS IN VOLUME. *Petroleum Engr.* **21C**, 11-12, 14 (1949) *August.*

Clark compressors designed for the Carthage Hydrocol oxygen plant are described. The two main units are three-stage, centrifugal compressors each driven by 23,000 hp steam turbines.

J. D. Parent

Foster, T. R. APPLICATION OF CENTRIFUGAL AND OF AXIAL COMPRESSORS. *Petroleum Refiner* **28**, 98-102 (1949) *August.*

See *Gas Abstracts* 5, 137 (1949) *June* for abstract.

Greene, R. M. THE GAS TURBINE PARTICULARLY AS APPLIED TO THE HIGH PRESSURE CENTRIFUGAL PIPELINE BOOSTER. *Calif. Oil World* **42**, 3, 7, 9-11, 48 (1949) *August*, 1st issue.

The advantages of the gas turbine for driving centrifugal compressors on pipeline booster duty are reviewed. The theory and factors influencing the efficiency and cost of gas turbines are briefly discussed.

O. T. Bloomer

Love, F. H. MODERN STATIONS — COMPRESSOR STATION PUMPS 182 MILES. *Petroleum Engr.* **21D**, 9-10, 12-15 (1949) *September.*

The Hugoton station of Cities Service Company is described in considerable detail.

J. D. Parent

McCarthy, J. E. CENTRIFUGAL COMPRESSORS FOR PIPE LINE DUTY. *World Oil* **129**, 187-188, 190, 192 (1949) *September.*

Characteristics of a centrifugal compressor closely parallel those of a centrifugal pump except for the increased density and heating of the gas compressed. When suction volume is reduced to 40% of normal at any speed, surging is induced. There is not a great deal of data available yet for actual operation, but the centrifugal compressors on the Texas Eastern lines have given satisfactory service.

J. D. Parent

Stormont, D. H. NEW SOUTHERN MINERALS PLANT HANDLES 6,000,000 CU FT LOW-PRESSURE GAS DAILY FROM SOUTHWEST TEXAS FIELD. *Oil Gas J.* **48**, 83, 87-88 (1949) *August* 11.

6 Mcf is being gathered and compressed for main line transmission through the use of portable compressors which cost about $150 per installed hp. A description of the compressors, piping and manner of use is provided.

J. D. Parent

Conservation

Baker, H. H. PROGRESS IN GAS CONSERVATION. *Southern Gas Assoc. Progress* **1949**, 5, 8 *(August-September).*

The problem of gas conservation is discussed with particular reference to casinghead gas. It is presented from a producer's point of view.

J. D. Parent

Corrosion

Breston, J. N. NEW CHEMICAL TREATMENT OF FLOOD WATER FOR BACTERIA AND CORROSION CONTROL. *Oil Gas J.* **48**, 96-100, 124-125, 127 (1949) *August* 25.

Laboratory tests show that alkyl and argyl high-molecular-weight amine salts and certain condensed ethylene oxide amine compounds have considerable acid-water corrosion inhibiting properties as well as being efficient bactericides. Most of the compounds tested are effective as corrosion inhibitors and bactericides in concentrations of about 10 ppm. The low concentrations of these compounds required results in a cost of 0.6 mils per bbl of flood water tested.

B. E. Hunt

Doremus, E. P., Doremus, G. L. and Parker, M. E., Jr. ENGINEERING ASPECTS OF CATHODIC PROTECTION AS APPLIED TO PIPE LINES. *Corrosion* **5**, 273-281 (1949) *September.*

Three generally recognized criteria for complete cathodic protection are based on (1) current density, (2) potential, and (3) current-potential relationships. The design problem discussed here is that of designing a completely protective system so that a minimum of 0.85 volts negative potential with respect to a copper sulfate electrode will be maintained everywhere on the pipe. Data is presented, substantiated by theoretical considerations, which indicates that complete protection at a minimum current demand can be obtained by the use of a large number of relatively small drainage points. Sacrificial galvanic anodes fulfill this demand for small closely spaced units. A comparative cost analysis between a magnesium anode installation and a rectifier ground bed installation is presented which shows a savings of approximately 360 dollars per mile for a 10 year period for the magnesium anode installation.

B. E. Hunt

Eilerts, C. K., Smith, R. V., Archer, F. G., Burman, L. M., Greene, F. and Hamontre, H. C. FIELD AND LABORATORY TESTS OF SODIUM CHROMATES AND ALKALIES FOR CONTROLLING CORROSION IN GAS CONDENSATE WELLS. PART II. THEORETICAL CONSIDERATIONS. *World Oil* **129**, 173-174, 176-178, 182 (1949) *August.*

A chart is presented indicating the solubility of CO_2 in distilled water at various pressures and temperatures. A second chart showing the pH of solutions of different materials in distilled water at 77°F is shown. The reduction of chromates to insoluble oxides has been studied and it has been found that acid chromates are more susceptible to reduction. Minimum reduction of chromates in test wells seems to take place when only sufficient chromate is injected to provide a recognizable excess at the well head.

B. E. Hunt

Eilerts, C. K., Smith, R. V., Archer, F. G., Burman, L. M., Greene, F. and Hamontre, H. C. FIELD AND LABORATORY TESTS OF SODIUM CHROMATES AND ALKALIES FOR CONTROLLING CORROSION IN GAS CONDENSATE WELLS. PART III. MAXIMUM AND MINIMUM REQUIREMENTS OF SODIUM CHROMATE DETERMINED. *World Oil* **129**, 156, 158, 160-162, 164 (1949) *September.*

A graphical and tabular presentation is made of the data obtained during corrosion control tests using sodium chromates and alkalies and extending from October 1945 to August 1947. The test indicated a need (1) to determine proper amount of water to inject to saturate the gas and carry the dissolved and suspended solids; and (2) to minimize the reduction of water soluble chromates to water insoluble chromates.

B. E. Hunt

Heck, E. T., Barton, J. K. and Howell, W. E. FURTHER FIELD-TEST RESULTS ON USE OF CORROSION INHIBITORS FOR SECONDARY FLOOD WATERS. *Oil Gas J.* **48**, 83, 85, 89, 91, 94 (1949) *September* 8.

Field test results are given for three corrosion inhibitors tested in six separate leases having

different types of water. Satisfactory organic growth control was obtained with all the inhibitors tested. The oil production graphs are given but no interpretation is drawn of the effect of the inhibitors.

B. E. Hunt

Jones, E. N. CORROSION CONTROL...A REPORT OF A 3-YEAR EXPERIENCE WITH A VARIETY OF INHIBITORS AT WEST TULETA FIELD, TEXAS. *Oil Gas J.* **48**, 107-109, 112, 114-115 (1949) *September* 15.

This is a report of the use of Kontol-116, 117, and 118 in controlling the corrosion of condensate field equipment. Results indicate that the use of sufficient inhibitor gave completely satisfactory corrosion control without affecting the producing formation or plugging the tubing and at a chemicals cost of less than anticipated. The inhibitor was fed to the equipment by the use of an old style drip lubricator.

B. E. Hunt

Lochte, H. L., Burnam, C. W. and Meyer, W. H. ORGANIC ACIDS PRODUCED BY HIGH PRESSURE GAS WELLS. *Petroleum Engr.* **21C**, 34-38, 40 (1949) *August.*

The procedure used in identifying the organic acids produced by high pressure gas wells is described. The identity of the various acids is given.

B. E. Hunt

CATHODIC PROTECTION NOTIFICATION PROCEDURES *Corrosion* **5**, 2-6 (1949) *September.*

A notification procedure to be followed upon installing cathodic protection on an existing structure or upon revising an existing structure is suggested by the correlating committee. The extent of interaction between structures as determined by (1) "Influence" of protective installations, (2) "Coupling" between structures, and (3) "Susceptiveness" of exposed structure should be determined in conference with the other companies involved. Appendices are attached which list (a) the various Joint Electrolysis Committees, (b) publishers of maps and directories, (c) location of district offices of the Long Lines Department of AT and T, and (d) location of the area offices of Western Union Telegraph Co.

B. E. Hunt

JOINT CATHODIC PROTECTION SYSTEMS. *Corrosion* **5**, 7-9 (1949) *September.*

This bulletin discusses the techniques of design, installation, and possible division of responsibility for the construction, operation, and maintenance of a joint cathodic protection system. A cost sharing procedure is described. An outline of the principal points to be included in a joint agreement is given.

B. E. Hunt

Dehydration

Simpson, J. APPARATUS FOR DEHYDRATING NATURAL GAS. U.S. 2,477,772 (1949) August 2.

An apparatus for dehydration of natural gas, prior to distribution, by compression and chilling in a receiving tank is described.

J. D. Parent

Hydrocarbon Recovery

Garrison, A. D. (assigned to Texaco Development Corp.) RECOVERY OF HYDROCARBONS. U.S. 2,477,367 (1949) July 26.

The invention relates to a process for recovering liquefiable hydrocarbons from high pressure hydrocarbon fluids, particularly from condensate reservoirs. A process is described in which a retrograde gas is expanded in an engine into the retrograde region in the presence of an absorption oil. The liquid phase is separated and the gas compressed for cycling. Advantages claimed are lower temperature and greater liquefaction due to more nearly reversible conditions than are obtained by free expansion. Another advantage is the lower compression required. It is planned to use the work of expansion.

J. D. Parent

LIGHT HYDROCARBON RECOVERY AND SEPARATION PROCESSES. *Petroleum Refiner* 28, 213, 216-217, 220-221, 224-225, 228-229, 232-233, 236-237, 240 (1949) *September.*

Current procedures for recovering liquefiable hydrocarbons from natural gases are reviewed. Processes treated include simple compression, simple absorption, rich oil venting, rich oil deethanizing, presaturation, multiple absorption and the use of dual stripping stills.

J. D. Parent

LP-Gas

Martin, J. W. THE FUNDAMENTALS OF VAPORIZATION. *LP-Gas* 9, 31-37, 79-83 (1949) *September.*

To be sure that the two essentials of LP-gas service, pressure and vapor, will be adequately provided, determine: (1) the minimum pressure that is needed; (2) the number of gallons per hr that must be vaporized; (3) the lowest temperature that may be expected in the coldest weather; (4) the grade or grades of gas that will be used; and (5) the size of the storage tank required. Then determine whether or not atmospheric air heat under these conditions will provide service when the tank is 10% full. If not, apply the additional heat with a direct fired tank heater. If butane or mixtures are to be used, (1) determine the tank insulation thickness to give the greatest economy of operation, and (2) install service piping to prevent condensation of the vapors after leaving the tank. Specific illustrations are given.

E. F. Davis

Natural Gasoline

Albright, J. C. GASOLINE PLANT EMPHASIZES COMPACTNESS. *Petroleum Engr.* 21C, 32, 34-36, 38 (1949) *September.*

The plant processes 40 MMcf of gas per day. The absorber operates at a pressure of 450 psi and contains 20 plates. Absorption oil molecular weight is 150 and 10 gal are used per Mcf of gas heated. A rich oil deethanizer of unusual design is employed.

J. D. Parent

Glendening, A. S. and Sanderson, C. F. SHORT CUT PROCESS DESIGN TO INCREASE PROPANE RECOVERY IN GASOLINE PLANTS. PART 7. GAS FRACTIONATION. *Petroleum Processing* 4, 893-897 (1949) *August.*

A low temperature fractionation process in place of the conventional oil absorption process is recommended as simpler, cheaper and giving greater propane recovery. Wet gas is chilled and sent to a fractionator whose reflux is refrigerated by a propane system. This tower produces a residue gas as overhead product and a deethanized gasoline as bottom product so that the conventional absorber, still and stabilizer, together with auxiliaries, are replaced by this system. Treatment of the bottoms in a conventional depropanizer and debutanizer follows.

J. D. Parent

Glendening, A. S. and Sanderson, C. F. SHORT CUT PROCESS DESIGN TO INCREASE PROPANE RECOVERY IN GASOLINE PLANTS. PART 8. GAS FRACTIONATION, CALCULATIONS. *Petroleum Processing* 4, 999-1002 (1949) *September.*

This is the eighth and last of a series on gasoline plant calculations. Some fractionator design calculations are given.

J. D. Parent

McAllister, W. S. PROPANE RECOVERY INCREASED FROM 68 TO 92 PER CENT AT WARREN'S GLADEWATER, TEXAS PLANT SINCE THE INSTALLATION OF NEW ABSORPTION OIL SYSTEM. *Oil Gas J.* 48, 101, 103, 105 (1949) *August* 25.

Use of newly designed equipment has led to an increase of propane recovery from 68 to 92% with a substantial reduction of the plant fuel and steam required. Refrigeration of lean oil and entering gas to 40° was discarded and the gas is now compressed to 245 psig and contacted with oil cooled by regular cooling water. There are three oil intertray coolers for the absorber. The gas treated is very rich so that separate deethanizers are employed for rich oil and condensate. A reabsorber with an intertray cooler and a single still complete the equipment.

J. D. Parent

Schuster, R. A. and Stewart, R. M. FEAZEL AND KINSEY PLANT EMPLOYS UNUSUAL DESIGN. *Petroleum Refiner* **28**, 91-96 (1949) *August.*

This plant is designed to process 210 MMcf per day and recover 7000 bbls per day of liquid products. Propane recovery is 60%. Features include refrigeration of lean oil to 60°F and use of low molecular weight oil. Increased selectivity, reduced fixed gas load, 50% reduction of size of lean oil handling equipment and lower still temperature are claimed. A dual still is used and no open steam is admitted to the low pressure still so as to keep the lean oil dry. Gas is dehydrated before admission to the absorbers which operate at 1,050 psi.

J. D. Parent

Swerdloff, W. REFRIGERATION-COMPRESSION SYSTEM BOOSTS PROPANE RECOVERY TO 70%. *Petroleum Processing* **4**, 993-997 (1949) *September.*

The plant described is of the simple compression refrigeration type with a typical raw gasoline fractionation section. Capacity is about 8,000 Mcf and chilling to 13°F after dehydration is practiced. Flow sheets are given.

J. D. Parent

Production

Calhoun, J. C., Jr. ENGINEERING FUNDAMENTALS — PHASE CONCEPTS — PHASE STATE OF RESERVOIRS. *Oil Gas J.* **48**, 107 (1949) *August* 11.

The effect of the temperature and pressure levels in the reservoir and at the surface on production are analyzed. The difference between a condensate and retrograde condensate reservoir is pointed out.

J. D. Parent

Dale, C. R. BOTTOM HOLE FLOW SURVEYS FOR DETERMINATION OF FLUID AND GAS MOVEMENTS IN WELLS. T.P. 2644. *J. Petroleum Technol.* **1**, *Trans. Section* 205-210 (1949) *August.*

A sensitive velocity recorder for use in determining fluid movement in wells is described. Some applications such as determination of leaks in casing are discussed.

J. D. Parent

Elliott, W. D. ALIGNMENT CHARTS FOR PERMEABILITY CALCULATIONS. *World Oil* **129**, 150-152, 154 (1949) *September.*

Alignment charts are presented for rapid calculation of permeability.

J. D. Parent

Keller, W. D. and Morse, R. A. SOME EXAMPLES OF FLUID FLOW MECHANISM IN LIMESTONE RESERVOIRS. T.P. 2638. *J. Petroleum Technol.* **1**, *Trans Section*, 224-234 (1949) *August.*

The problem of predicting the susceptibility of a given limestone reservoir to secondary recovery methods requires a comprehensive analysis of the performance history of the field.

J. D. Parent

Loper, R. G. and Calhoun, J. C., Jr. THE EFFECT OF WELL SPACING AND DRAWDOWN ON RECOVERY FROM INTERNAL GAS DRIVE RESERVOIRS. T. P. 2592. *J. Petroleum Technol.* **1**, *Trans. Section* 211-218 (1949) *August.*

It is concluded that the history of an internal gas drive reservoir is independent of the well spacing or pressure drawdown.

J. D. Parent

Miller, C. C., Brownscombe, E. R. and Kieschnick, W. F., Jr. A CALCULATION OF THE EFFECT OF PRODUCTION RATE UPON ULTIMATE RECOVERY BY SOLUTION GAS DRIVE. T.P. 2565. *J. Petroleum Technol.* **1**, *Trans. Section*, 235-247 (1949) *September.*

Any condition causing large pressure differences over large areas may result in substantial loss in ultimate oil recovery as shown by the authors' calculations.

J. D. Parent

Squires, F. MEASURING OIL RESERVES BY INJECTED GAS. *World Oil* **129**, 170-174 (1949) *September.*

It is proposed that the oil remaining in a reservoir be evaluated by injecting gas and apply-

ing the gas laws. Such factors as gas dissolving in oil should be taken into consideration. The sand must be quite permeable.

J. D. Parent

Tinker, N. A., Jr. PLANNING, RUNNING, AND CEMENTING CASING STRINGS. *Petroleum Engr.* **21B**, 11-16 (1949) *July.*

Some helpful suggestions for cementing casing are given.

J. D. Parent

Walker, A. W. SQUEEZE CEMENTING. *World Oil* **129**, 87-90, 92, 94, 96 (1949) *September.*

It is assumed that cement or mud displacement proceeds as follows: displacement of mud behind pipe; vertical fracturing of formations; dehydration of mud and cement; horizontal fracturing of beds. Pressures high enough to exceed the weight of the overburden occur only near the end of squeeze operations and indicate an impervious cement job.

J. D. Parent

Wiss, W. A. COMBINATION COOLING-WATER SYSTEM. *Oil Gas J.* **48**, 92, 95-96 (1949) *August* 11.

A single cooling water unit for use with engine oil, engine jackets and compressor jackets is described.

J. D. Parent

A METHOD OF EMBEDDING LARGE CORES IN PLASTIC FOR FLUID FLOW STUDIES. *J. Petroleum Technol.* **1**, *Sec.* 1, 18-22 (1949) *August.*

A method for embedding cores in plastic is presented. The technique is fully described. A sealing with a phenol-formaldehyde resin is followed by formation of a layer of methyl methacrylate polymer (lucite).

J. D. Parent

Purification

Scharmann, W. G. (assigned to Standard Oil Development Co.) PROCESS FOR PURIFYING GASES. U.S. 2,477,314 (1949) July 26.

An improved process is claimed for the removal of large amounts of weakly acidic constituents from gaseous mixtures by scrubbing at superatmospheric pressure with ethanolamine, phosphate, carbonate, or other common solvents for CO_2 and H_2S; and desorbing the CO_2 or H_2S by suddenly reducing the pressure on the solvent to atmospheric pressure. To obtain gases of high purity, a second stage scrubber consisting of conventional apparatus may be employed. Appreciable savings in operating costs are claimed.

H. Hakewill

Storage

Resnick, I. LIQUEFACTION FOR STORAGE OF NATURAL GAS SHOWS PLANT INVESTMENT ECONOMY. *Am. Gas J.* **171**, 23-24 (1949) *August.*

Cascade refrigeration is more economical than compressing, cooling and flashing. The ammonia-ethylene cascade system appears to be most economical. A plant investment for liquefaction, storage and regasification using this system amounts to $7.00 per Mcf as opposed to $5.00 per Mcf for propane-air and $100 per Mcf for conventional gas holders. Once the plant has been installed peak load gas can be supplied at a much lower cost than from oil gas or propane-air facilities. Factors which influence the plant investment and some means of effecting economies are discussed.

J. D. Parent

Transmission

Joffe, J. GAS FLOW IN LONG PIPELINES. *Chem. Eng.* **56**, 130-131 (1949) *August.*

The method of Clinedinst (*Am. Gas J.* **162**, 3, 12, 1945) for evaluating the effect of supercompressibility on pressure drop for isothermal gas flow is reworked into a form which is said to be more convenient. Graphical correlations are furnished for use in the calculations.

J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Heath, H. E. F. RELAYING SERVICES WITH COPPER TUBING. p. 238.

Rohman, A. METERS CHANGED WITHOUT INTECRUPTING GAS FLOW TO APPLIANCES. p. 239.

PIPE JOINTS REPAIRED FROM INSIDE MAIN. p. 238.

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Coal Hydrogenation

Hirst, L. L., Markovits, J. A., Skinner, L. C., Dougherty, R. W. and Donath, E. E. ESTIMATED PLANT AND OPERATING COSTS FOR PRODUCING GASOLINE BY COAL HYDROGENATION. U.S. Bureau of Mines Report of Investigations 4564 (1949) August.

The technical feasibility of coal hydrogenation has been demonstrated adequately by industrial operations abroad totalling 90,000 bbls per day. The German plants had a thermal efficiency of 33% or less while modernized plants should achieve 45 to 50%, depending upon the coal used. For the production of 30,000 bbls per day of liquids, including some 20,000 to 22,500 bbls of gasoline, the plant erection cost is about $250,000,000. Detailed cost calculations for 5 coals and for various product credits are shown as well as a description of the proposed plant.

C. H. Riesz

Corrosion

Bartz, M. A. and Rawlins, C. E. HYDROGEN BLISTERING OF STEEL A SOURCE OF DAMAGE TO VESSELS. *Petroleum Processing* 4, 898-900 (1949) *August.*

The cause of blistering of vessel walls and other refinery equipment is found to be the attack of atomic hydrogen released by acid corrosion of steel. Blistering can be avoided by using corrosion resistant steels, removing the corrodent, and improving the homogenity of the steel. Included in an appendix are several case histories of hydrogen blistering and hydrogen embrittlement.

B. E. Hunt

Cost Data

Roberts, G., Jr. and Schultz, P. R. PRODUCTION OF LIQUID FUELS FROM COAL AND OIL SHALE. *Oil Gas J.* 48, 116-117 (1949) *September* 15.

On the basis of present technological developments, costs of producing liquid fuels from coal and oil shale are estimated in order to evaluate these materials as potential replacements for crude petroleum. Based on the assumption that products are delivered to the Chicago area, gasoline would cost 27.6¢ per gallon from Montana subbituminous coal, 22.5¢ from Indiana bituminous coal, 22.5¢ from Colorado oil shale (Union Oil Company upflow retort process) and 15.0¢ from Gulf Coast natural gas. For comparison, gasoline from Wyoming crude, a marginal crude oil, costs 12.2¢ per gallon. It is concluded that at present, coal and oil shale cannot compete as raw materials with crude oil while natural gas may or may not be competitive depending upon the relative locations of raw material supply and product markets.

C. H. Riesz

Cracking

Haensel, V. and Sterba, M. J. PYROLYTIC AND CATALYTIC DECOMPOSITION OF HYDROCARBONS. *Ind. Eng. Chem.* 41, 1914-1922 (1949) *September.*

Research and development in hydrocarbon decomposition during 1948 and early 1949 are reviewed. New processes announced include Thermofor pyrolytic cracking (TPC) for production of ethylene and aromatics, Catarole oil cracking process for production of chemicals, Houdriflow (modified TCC) process and Platforming (reforming of gasoline over a platinum catalyst). Various aspects of catalytically cracking high sulfur feeds received considerable attention. 109 references are presented. [*Gas Abstracts* 4, 198 (1948) refers to a previous review by the same authors.]

C. H. Riesz

Fischer-Tropsch Synthesis

D'Ouville, E. L. (assigned to Koppers Co., Inc.) REACTIVATION OF CATALYSTS IN HYDROCARBON SYNTHESIS. U.S. 2,478,899 (1949) August 16.

Catalysts for the synthesis of hydrocarbons from carbon monoxide and hydrogen are regenerated by low temperature hydrogen treatment. Thus, when the efficiency of the catalyst has dropped to 30% of its normal activity, hydrogen is passed over the catalyst at 122°F for a

period of 0.5 to 5.0 hrs to reactivate the catalyst. Need for a subsequent induction treatment to form a carbide layer is obviated by this method.

C. H. Riesz

Keith, P. C. (assigned to Hydrocarbon Research, Inc.) CONTROLLING CATALYTIC EXOTHERMIC REACTIONS OF GASIFORM REACTANTS. U. S. 2,479,496 (1949) August 16.

In the synthesis of hydrocarbons from carbon monoxide and hydrogen, excessive temperatures above the fluidized catalyst bed occur as a result of a localized exothermic reaction. These are avoided by passing the total products through a second fluidized catalyst bed maintained at a temperature lower than that of the reactor bed.

C. H. Riesz

Krebs, R. W. (assigned to Standard Oil Development Co.) TWO STAGE REDUCTION PROCESS FOR PRODUCING METAL CATALYST. U.S. 2,481,226 (1949) September 6.

The presence of substantial amounts of water in the hydrogen used for reducing synthesis catalysts reduces their activity when employed subsequently in hydrocarbon synthesis. By reduction of a major portion of the cobalt oxide content of the catalyst into metallic cobalt with "wet" hydrogen, the final reduction only may be conducted with substantially anhydrous hydrogen to produce active catalysts.

C. H. Riesz

Seelig, H. S. and Zisson, J. (assigned to Standard Oil Company) CATALYST FOR CARBON MONOXIDE-HYDROGEN SYNTHESIS. U.S. 2,480,341 (1949) August 30.

For the conversion of carbon monoxide-hydrogen mixtures into hydrocarbons, an improved iron catalyst is produced by the addition of iron fluoride promoter (e.g., 0.1 to 5 mole-% based on iron content of catalyst).

C. H. Riesz

Segura, M. A. (assigned to Standard Oil Development Co.) CATALYST RECOVERY IN HYDROCARBON SYNTHESIS PROCESSES. U.S. 2,479,420 (1949) August 16.

In order to maintain the fluidizing properties of iron catalyst used for the synthesis of hydrocarbons from carbon monoxide and hydrogen, a portion is continuously withdrawn, and after sintering in an oxidizing atmosphere, the regenerated catalyst is ground to a size of from 40 to 200 microns. The iron catalyst in the reaction zone should not contain more than 20% smaller than 20 microns.

C. H. Riesz

Voorhies, A., Jr. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS OPERATION. U.S. 2,479,439 (1949) August 16.

In order to obtain selectivity in the production of hydrocarbons from carbon monoxide and hydrogen, an alkali metal promoter (such as potassium fluoride in dilute aqueous solution) is injected into a fluidized reaction zone containing unpromoted iron catalyst. The addition is continued until the desired yields of liquid hydrocarbons are obtained, at which time the percentage of promoter based on the iron will be from 0.5 to 2.5 wt-%. Water is also fed into the reaction zone to suppress catalyst carbonization, the amount being such that 7 to 15 moles of hydrogen per mole of water are contained in the total feed.

C. H. Riesz

Petrochemicals

Marek, L. F. OXIDATION. *Ind. Eng. Chem.* 41, 1892-1900 (1949) *September.*

Developments in the field of oxidation during the past year are reviewed. Gasification of coal and conversion of natural gas into synthesis gas have received considerable attention. McCarthy Chemical Company completed the first tonnage oxygen plant (175 tons of 90 to 95% oxygen) in the spring of 1949 to be used in the manufacture of petrochemicals. 140 references are cited. [A previous review by the same author appeared in *Ind. Eng. Chem.* 40, 1635-1642 (1948) *September.*]

C. H. Riesz

Sherwood, P. W. FROM SYNTHETIC FUELS, WHAT CHEMICALS! *Chem. Eng.* 56, 99-101 (1949) *September.*

Chemicals associated with the production of

synthetic fuels from various sources are discussed. Oxygenated compounds are produced in association with Fischer-Tropsch hydrocarbon products; tar acids and bases are important byproducts in coal hydrogenation. Large quantities of nitrogen compounds may be recovered in the distillation of shale oil.

C. H. Riesz

Production

Stormont, D. H. PRESSURE MAINTENANCE AT MAGNOLIA. *Oil Gas J.* 48, 60-62, 64, 101 (1949) *September* 8.

Through returning all salt water to the Reynolds lime pool and by controlling volumetric withdrawals from the reservoir in line with field rules issued by the Arkansas Oil and Gas Commission, operators in Magnolia field of Southwest Arkansas have held bottom-hole pressures of this reservoir to a nominal rate of decline for nearly 4 years. As a result of this program, which has almost tripled the oil recovered per pound pressure drop, the pool's ultimate oil yield is expected to approximate 122,000,000 bbl, which represents a recovery factor of 50%. Since a relatively strong water drive already existed in the Reynolds lime pool, engineers familiar with the project have been somewhat reluctant to make any claims as to increased ultimate oil recovery because of the water injections.

Excerpt from article

Sulfur

Seyfried, W. D. SYNTHESIS, PROPERTIES, AND IDENTIFICATION OF SULFUR COMPOUNDS IN PETROLEUM. *Chem. Eng. News* 27, 2482-2486, 2516 (1949) *August* 29.

The author, who is chairman of the API Advisory Committee for Project 48, outlines the need for research on the sulfur content of crude oils and refined products; and describes the program formulated for this investigation. The work of API Project 48 is directed primarily toward the identification and measurement of sulfur compounds in typical crude oils, and the development of fundamental information on physical and thermodynamic properties of pure sulfur compounds for the purpose of studying the characteristics and possible reactions of sulfur occurring in petroleum. Limited work with the mass spectrometer and infrared spectrophotometer has indicated that the intensity of absorption of sulfur compounds is relatively weak and that the estimated minimum concentrations of various typical sulfur compounds required for detection in admixture with hydrocarbons are in the order of 3 to 5%.

H. Hakewill

SULFUR FROM SOUR REFINERY GASES. *Petroleum Processing* 4, 891-892 (1949) *August.*

Hydrogen sulfide is extracted from sour refinery gases in plants adjacent to Long Beach, California, in the new sulfur plant of Hancock Chemical Company. The H_2S is absorbed in diethanolamine (DEA) at the individual refineries, and the H_2S-rich DEA solution then returned to the chemical plant through pipelines. At the chemical plant it is steam-stripped to remove H_2S, and the regenerated DEA solution pumped back to the refineries for re-use. The H_2S is converted to sulfur by a modified Claus process, in which part of the H_2S is burned to sulfur dioxide, which is then reacted with the unconverted H_2S to yield elemental sulfur of 99.8% purity.

Editor's abstract

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Mayland, B. J. and Hays, G. E. THERMODYNAMIC STUDY OF SYNTHESIS GAS PRODUCTION FROM METHANE. p. 239.

Shreve, R. N. ALKYLATION. p. 252

Squires, F. MEASURING OIL RESERVES BY INJECTED GAS. p. 244.

7. ANALYTICAL METHODS AND TESTS

Automatic Titration

Austin, R. R., Turner, G. K. and Percy, L. E. AN APPLICATION OF FEEDBACK ELECTRONIC CONTROL TO AUTOMATIC CONTINUOUS TITRATION. *Instruments* 22, 588-589 (1949) *July.*

The principle of operation, features, performance, and application of an electronic device for automatic continuous measurement and recording of concentration is described. This apparatus was originally designed for the measurement of mustard-gas concentration in air by titration with electrolytically generated bromine, and operating at an air-flow rate of 1 liter per minute has a sensitivity limit of 0.1 ppm beta-beta'- dichlorodiethyl sulfide in air. Other sulfur compounds successfully titrated with this unit are: H_2S, SO_2, and mercaptans. Compounds not susceptible to titration are: CO, CS_2, aldehydes, ketones, olefins, diolefins, and acetylene. Experimental field work relating to the measurement of the concentration of sulfur compounds is in progress and an effort to design instruments of this type for commercial manufacture is being made.

H. Hakewill

Carbon Monoxide

Lindsley, C. H. and Yoe, J. H. A CONTINUOUSLY INDICATING INSTRUMENT FOR CARBON MONOXIDE IN AIR. *Analytica Chimica Acta* 3, 445-451 (1949) *July.*

An instrument is described that, operating continuously, will indicate when certain specified concentrations of carbon monoxide are present in the air drawn through the apparatus. This is accomplished by oxidizing the carbon monoxide over Hopcalite and measuring the rise in temperature resulting from the oxidation. Specially designed thermometers are used, with platinum contacts sealed in the stem at intervals corresponding to the gas concentrations it is desired to determine. When these contacts are closed by the rising thread of mercury appropriate signalling devices are put into operation.

Authors' summary

Hydrogen

Pepkowitz, L. P. and Proud, E. R. DETERMINATION OF HYDROGEN. *Anal. Chem.* 21, 1000-1003 (1949) *August.*

A universal gasometric micromethod for the determination of hydrogen in organic, inorganic, and metal-organic compounds, and low melting metals is presented. The method is independent of the composition of the sample. The sample, within a sealed iron capsule, is heated inductively at 700°C to bring about the evolution of hydrogen. The liberated hydrogen diffuses through the wall of the iron capsule into a vacuum system. The hydrogen is measured by the reduction of pressure in the system after the oxidation of the hydrogen to water is achieved with a copper oxide catalyst at 400°C. The average error for the method is 0.2% and the total elapsed time for the determination is approximately 60 minutes.

M. C. Miyaji

Mercaptans

Kolthoff, I. M. and Harris, W. E. AMPEROMETRIC DETERMINATION OF PRIMARY AND TERTIARY MERCAPTANS IN THEIR MIXTURES. *Anal. Chem.* 21, 963-965 (1949) *August.*

A method for determining the composition of a mixture of a primary and tertiary mercaptan by an argentometric amperometric titration combined with an iodometric amperometric titration in the presence of a lead salt is described. The presence of the lead salt prevents the mercaptans from reacting to form mixed disulfides during the iodometric titration while permitting the primary mercaptan to be oxidized to the disulfide and the tertiary mercaptan to react with iodine to form sulfenyl iodides. The endpoint determined amperometrically for secondary mercaptans is reported to be indefinite and the authors consider the results inaccurate. It is the authors' opinion that the method for primary and tertiary mercaptan is of limited accuracy because it is indirect and some tertiary mercaptans react incompletely with iodine.

H. Hakewill

Microanalyzer

Stover, C. N., Jr., Partridge, W. S. and Garrison, W. M. SIMPLIFIED GAS MICRO-ANALYZER. *Anal. Chem.* **21**, 1013 (1949) *August.*

The design and operation of a simplified apparatus for the micro-analysis of gas is illustrated and described.

H. Hakewill

Spectroscopy

Anderson, J. A., Jr. and Zerwekh, C. E., Jr. DETERMINATION OF IMPURITIES IN n-HEPTANE CONCENTRATES. *Anal. Chem.* **21**, 911-914 (1949) *August.*

An infrared absorption method for the quantitative determination of seven possible impurities of 90-99% pure n-heptane is shown to have an accuracy for an individual component of $\pm 0.2\%$ based on the total sample. To obtain this accuracy a method of calibration and calculation was used whereby the optical density of the impure n-heptane was compared with that of pure n-heptane, thus eliminating several errors inherent in standard single beam infrared technique. The complete determination requires approximately two hours.

D. V. Kniebes

Gifford, A. P., Rock, S. M. and Comaford, D. J. MASS SPECTROMETER ANALYSIS OF ALCOHOLS AND OTHER OXYGENATED DERIVATIVES. *Anal. Chem.* **21**, 1026-1032 (1949) *September.*

The application of the mass spectrometer to analyses involving water and alcohols is described. It is shown that earlier difficulties were due to adsorption of the materials with elution during subsequent runs. By changing the sample inlet system and modifying the operating procedure, it has been found possible to determine alcohols to the butanols as well as water with adequate precision.

S. Katz

Tunnicliff, D. D., Brattain, R. R. and Zumwalt, L. R. BENZENE, TOLUENE, ETHYLBENZENE, o-XYLENE, m-XYLENE, AND p-XYLENE. *Anal. Chem.* **21**, 890-894 (1949) *August.*

A procedure for the determination of benzene, toluene, ethylbenzene, o-xylene, m-xylene, and p-xylene by ultraviolet spectrophotometry is described which is correct to 1% in the case of all constituents except toluene and ethylbenzene which are determined to 2%. A very detailed discussion of the theory and experimental procedure is included, together with methods for testing for the presence of interfering impurities and their elimination.

S. Katz

Tunnicliff, D. D., Rasmussen, R. S. and Morse, M. L. CORRECTION FOR INTERFERING ABSORPTION IN SPECTROPHOTOMETRIC ANALYSES. *Anal. Chem.* **21**, 895-900 (1949) *August.*

A method of correcting for the effect of interfering absorption in spectrophotometric analysis is described. The method assures that the interfering absorption may be represented by an analytic function of wave length. Application of the method to systems involving benzene, toluene, the xylenes, ethyl benzene and napthalene are given in detail.

S. Katz

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Seyfried, W. D. SYNTHESIS, PROPERTIES, AND IDENTIFICATION OF SULFUR COMPOUNDS IN PETROLEUM. p. 248.

8. GENERAL AND PHYSICAL CHEMISTRY

Catalysts

Nahin, P. G. and Huffman, H. C. ALUMINA AND ALUMINA-SUPPORTED CATALYSTS. *Ind. Eng. Chem.* 41, 2021-2027 (1949) *September.*

Various forms of alumina, a silica-stabilized synthetic gel alumina catalyst support calcined at a series of elevated temperatures, and fresh and thermally deactivated molybdena-alumina and cobaltia-molybdena-alumina catalysts were examined with the electron microscope. Catalytic activities, X-ray examination and surface area data are given and discussed. It is concluded that the resolving power of the electron microscope at present is insufficient to determine catalyst morphology. For the particular catalysts inspected, active catalysts have microcrystals of 500 Angstroms in size or less; deactivated catalysts have particles of the order of several thousand Angstroms. Four types of pore structures in the carrier and freshly activated catalyst were differentiated.

C. H. Riesz

Kinetics

Hougen, O. A. and Hsu, J. P. APPLIED KINETICS AND EQUILIBRIA. *Ind. Eng. Chem.* 41, 1825-1832 (1949) *September.*

The significant papers on chemical kinetics and thermodynamics published in 1948 are surveyed very briefly. The section on kinetics includes paragraphs on general theory, diffusion, catalysis, dehydrogenation, halogenation, hydration, hydrogenation, ionic reactions, oxidation, photochemistry, polymerization, reduction, synthetic fuels and thermal decomposition and a bibliography of 160 references. The section on thermodynamics considers general theories, general properties, transport properties, helium, theory of solutions, chemical equilibria, vapor-liquid equilibria, gas-solid equilibria, liquid-liquid systems, solid-liquid systems, and solutions. A bibliography of 138 references accompanies the thermodynamic section.

S. Katz

Thermodynamics

Brinkley, S. R., Jr. and Lewis, B. COMBUSTION GASES. *Chem. Eng. News* 27, 2540-2541 (1949) *September* 5.

A table of the equilibrium composition and a number of the thermodynamic properties at equilibrium of systems containing carbon, hydrogen, oxygen and nitrogen has been computed for the temperature range between 1000 and 5000°K and pressure between 0.1 and 100 atmospheres. All possible combinations of the four elements may be interpolated from the tabulated data. The method of computation is outlined briefly. Because of the magnitude of the table it will not be published but will be filed on punched cards at the Bureau of Mines in Pittsburgh. Suggested applications of the tables include flame temperature calculations, engine performance, and gas synthesis processes.

S. Katz

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. PART XXI. EXPERIMENTAL VAPOR-LIQUID EQUILIBRIA METHODS AND EMPIRICAL CORRELATION OF DATA. *Petroleum Refiner* 28, 128-133 (1949) *August.*

Experimental methods used in the determination of liquid-vapor equilibria are described. Methods of correlating empirical data are described and illustrated. An extensive bibliography supplements the experimental part of the paper.

S. Katz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Arthur, J. R. and Bowring, J. R. THE COMBUSTION OF CARBON: INHIBITION OF SECONDARY REACTIONS BY VOLATILE REAGENTS ADDED TO THE OXIDIZING GAS. p. 234.

Gelus, E., Marple, S., Jr. and Miller, M. E. VAPOR-LIQUID EQUILIBRIA OF HYDROCARBON SYSTEMS ABOVE ATMOSPHERIC PRESSURE. p. 253.

9. ORGANIC CHEMISTRY

Alkylation

Shreve, R. N. ALKYLATION. *Ind. Eng. Chem.* 41, 1833-1840 (1949) *September.*

Progress in the field of alkylation during the past year is reviewed. 190 references are given. [*Gas Abstracts* 4, 198 (1948) refers to a previous review by the same author.]

C. H. Riesz

Friedel-Crafts Reactions

Groggins, P. H. FRIEDEL-CRAFTS REACTIONS. *Ind. Eng. Chem.* 41, 1880-1882 (1949) *September.*

Research and development during 1948 on the Friedel-Crafts reaction is reviewed. 25 references are listed.

C. H. Riesz

10. CHEMICAL ENGINEERING

Distillation

Bowman, J. R. and Cichelli, M. T. BATCH DISTILLATION. *Ind. Eng. Chem.* 41, 1985-1987 (1949) *September.*

Binary distillation curves (distillate composition vs. fraction of charge remaining in the pot) are characterized by the "pole height," defined to be equal to the product of the slope of the curve at mid-height and the fraction remaining in the pot. Formulas for minimum number of plates and minimum reflux for given pole height are calculated theoretically:

$$n' = \frac{\log 8S}{\log \alpha} \text{ and } R' = \frac{2S}{\alpha - 1}$$

approximately, where S is the pole height, α is the relative volatility, R′ is the minimum reflux ratio, and n′ is the minimum number of theoretical plates. The results are applied to comparison of batch distillations under various conditions of operation.

Authors' abstract

Cannon, M. R. A NEW DISTILLATION PACKING. *Ind. Eng. Chem.* 41, 1953-1955 (1949) *September.*

A protruded metal is offered as a highly efficient packing. It is comparable to Stedman in efficiency, less expensive than gauge or wire packings, readily wetted, requires no preflooding, and reaches equilibrium quickly. Test data are given on the packing for 2 in. and 4 in. diameter columns 8.5 and 9.5 ft respectively.

H. A. Dirksen

Heat Transfer

Bunnell, D. G., Irvin, H. B., Olson, R. W. and Smith, J. M. EFFECTIVE THERMAL CONDUCTIVITIES IN GAS-SOLID SYSTEMS. *Ind. Eng. Chem.* 41, 1977-1981 (1949) *September.*

Measurements of both gas and solid temperatures at various points along the diameter of a bed of 0.125 in. cylindrical pellets. The pellets were packed in a 2 in. tube and measurements were made of temperatures at seven points along a diameter at depths of 0, 2, 4, 6, and 8 inches in a total packed depth of 16 inches. Air was used in all runs, and the inlet temperature at the center of the bed was held at 400°C while the outer tube wall was held at 100°C. Effective thermal conductivities, K were computed from plots of temperature vs. r/r_0, with mass velocity as a parameter, r_0 being the tube radius and r the distance from the center to the point measured. At each bed depth mass velocities of 147 to 511 were employed. K values ranged from 0.1 to 0.4 Btu/(hr x ft x °F) and varied directly with the mass velocity of gas flow. No significant temperature differences between gas and catalyst were observed. From these two facts it was concluded that radial heat transfer was a function largely of gas characteristics.

C. L. Tsaros

McAdams, W. H., Kennel, W. E., Minden, C. S., Carl, R., Picornell, P. M. and Dew, J. E. HEAT TRANSFER AT HIGH RATES TO WATER WITH SURFACE BOILING. *Ind. Eng. Chem.* 41, 1945-1953 (1949) *September.*

Surface or local boiling is a form of nucleate boiling in which a sub-cooled liquid contacts a surface hot enough to produce bubbles which later condense in the main body of liquid. This study was made using degassed water flowing upward through a glass column 0.7 in. inside

diameter, containing a centrally located electric heater with an outside diameter of 0.25 inches. Heat flux density, Btu per sq ft, was found to be largely a function of the 3.86 power of surface temperature minus water saturation temperature, being independent of the water velocities (1 to 36 ft per sec), degree of subcooling (20° to 150°F) pressures (30 to 90 psia), and equivalent diameters (0.17 to 0.48 in.) studied. Data for non-boiling conditions were well correlated by familiar equations found in the literature. Transition to surface boiling occurs at a Δt at which the heat flux density for non-boiling conditions is equal to that for surface boiling and can be calculated from equations describing the two types of heating. In the transition region, the presence of dissolved gas increases the density of heat flux for a given Δt. Effect of pressure was very small, causing less than a $10^{\circ}\Delta t$ difference in the transition region.

C. L. Tsaros

Thermodynamics

Lewis, W. K. and Mickley, H. S. SOLVES INTERNAL ENERGY PROBLEMS. *Chem. Eng.* **56**, 105-106 (1949) *August.*

A graphical correlation is provided for the isothermal variation of internal energy with pressure in terms of reduced quantities. It is said to be good to within 5% for non-polar gases. It is shown how the isothermal effect of pressure on enthalpy and entropy can be computed with the aid of the graph provided.

J. D. Parent

Vapor-Liquid Equilibria

Calhoun, J. C., Jr. ENGINEERING FUNDAMENTALS: CALCULATION OF PHASE SEPARATION ON MULTI-COMPONENT SYSTEMS. *Oil Gas J.* **48**, 135 (1949) *September* 15.

The use of equilibrium constants to calculate the composition of the equilibrium liquid and vapor phases and their relative amounts is extended to the multicomponent system.

O. T. Bloomer

Gelus, E., Marple, S., Jr. and Miller, M. E. VAPOR-LIQUID EQUILIBRIA OF HYDROCARBON SYSTEMS ABOVE ATMOSPHERIC PRESSURE. *Ind. Eng. Chem.* **41**, 1757-1761 (1949) *August.*

A steel recirculation apparatus for obtaining equilibrium liquid and vapor samples is described. An excellent pressure control system is employed and considerable attention has been given to minimizing the errors inherent in the recirculation type apparatus. Data are presented for the system 2, 2, 4-trimethylpentane—toluene at 14.7, 29.7, and 59.7 psia. This system is useful for testing continuous fractionating columns. Data at atmospheric pressure are also presented for 2, 2, 4-trimethylpentane—methyl-cyclohexane. It is stated that this data is useful for testing columns with a high number of theoretical plates.

O. T. Bloomer

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Coke Oven

Van Ackeren, J. (assigned to Koppers Co., Inc.) COKE-OVEN DOOR. U.S. 2,478,215 (1949) August 9.

A self-sealing coke-oven door comprising the usual refractory-lined plug portion supported by a heavy metallic frame is described. A thin flexible sharp-edged sealing sheet is clamped to the frame by a heavy clamping-plate, to which is clamped by bolts an outer peripheral door frame. This frame overlaps the oven-chamber opening by the same amount as the flexible sealing edge and carries a number of plungers around its outer edge, each plunger forced by springs against the flexible sealing-edge, which in turn flexes to meet the machined sealing-surface of the metallic door-casing around the oven-opening when the door is held closed by latches. The compression of each spring is adjustable, thus permitting more or less flexing of the thin sealing strip as it meets the machined door-casing, or as it expands or contracts during the coking period.

O. P. Brysch

Instrumentation

Breedlove, H. B. REVISED DEPROPANIZER INSTRUMENTATION IMPROVES PLANT OPERATION. *Oil Gas J.* **48**, 132, 135-136, (1949) *August* 25.

Improved operation of a depropanizer was obtained by revising existing instrumentation and providing first derivative control to instruments subject to considerable process lag. Derivative control was applied to the feed preheater temperature control, the tower bottoms temperature control, and the tower pressure control. In addition the steam condensate level control on the reboiler and feed preheater was changed to a continuous drain type steam trap and a diaphragm operated valve on the inlet side. Operating charts are presented showing the kind of control obtained before and after making changes.

W. J. Merwin

Leslie, J.S. SIMPLIFIED INSTRUMENTATION. *Instruments* **22**, 670-674 (1949) *August.*

A discussion is presented of the principles of operation of self contained regulators of the internal-pilot, piston-operated type. The regulators may be pressure reducing valves, pump governors for reciprocating and turbine type steam pumps, or temperature regulators. Cross sectional drawings of the various types of valves are shown.

W. J. Merwin

Potten, A. J. NOTES ON INSTALLATION AND OPERATION OF AUTOMATIC INSTRUMENTS FOR ANALYSIS OF COMBUSTION FLUE-GASES. *J. Inst. Fuel* (British) **22**, 307-312 (1949) *August.*

The instructions given in makers' handbooks for the installation of automatic instruments for gas analysis relate to normal boiler and industrial furnace plants, where conditions are usually comparatively stable. The performance of experimental combustion equipment may well be subject to sudden, frequent and wide fluctuations, and some modifications to the standard methods of installation may be necessary if the instrument is to follow, as quickly and as accurately as possible, changes in the composition of the flue gases. These notes describe and dsicuss some such modifications, which have been evolved in the course of experimental furnace work by the British Coal Utilization Research Association. They are intended to supplement and not to replace the instructions in makers' handbooks and have been written especially for the investigator who has to use the instrument for applications outside its usual range. The recommendations for installation are applicable to most automatic instruments for analysis of flue gases, but they are mainly the result of experience with one instrument, the Mono. This instrument and its method of operation are described, and an account is given of means of reducing possible errors. Two experimental modifications are described to enable the instrument to measure gases outside its normal scope. The paper is of topical interest in view of the forthcoming publication, by the British Standards Institution, of British Standard Codes on (1) Indicating and Recording Instruments for Fluegas Analysis, and (2) Sampling and Analysis of Flue Gases.

Author's abstract

Pressure Vessels

Maccary, R. R. and Fey, R. F. DESIGN OF THICK WALLED PRESSURE VESSEL SHELLS. *Chem. Eng.* **56**, 124-127 (1949) *August.*

This is the first of a group of articles on design of high pressure vessels. The background of the Lamé formula is presented and charts are given showing the relationship between stresses calculated by the Lamé formula and by the membrane formula. Design charts are presented comparing the wall thickness calculated by the Lamé formula with the thickness calculated by the distortion energy equation. It is concluded that the latter equation be used when the vessel is subject to cycling conditions of varying temperature and pressure at regular or frequent intervals.

W. J. Merwin

Pumps

Brain, R. C., Hyde, J. W., and Judd, R. O. DESIGN AND DEVELOPMENT OF PUMPS FOR THE DEVELOPMENT LABORATORY. *Petroleum* (British) **12**, 219-223 (1949) *September.*

Five pumps specially designed for unusual service in a development laboratory are described. Included is a small gas recycle booster, an immersed pump for pumping heavy residue, a high pressure pump for liquefied gases, a rubber tube squeeze pump, and an electrolytic gas displacement pump in which the fluid is displaced by electrolytic gas generated under controlled conditions. An automatic column head is also described.

O. T. Bloomer

Vacuum Gauge

Fryburg, G. C. and Simons, J. H. A PRECISION VACUUM GAUGE. *Rev. Sci. Instruments* **20**, 541-548 (1949) *August.*

Very complete instructions are given for the construction and calculation of a precise Knudsen type vacuum gauge for use in the range between 10^{-3} to 10^{-5} mm Hg. The gauge is suitable for use in the condensable gases and organic vapors where the McLeod gauge and hot filament gauges are unsuitable.

S. Katz

Water-Cooling Tower

Degler, H. E. WATER-COOLING TOWER UPKEEP. *Operating Engr.* **2**, 36-37 (1949) *August.*

This is the third in a series of articles on water cooling towers. The author briefly discusses the necessity for water treatment and pH control and mentions some of the details which require attention in starting, operating, and shutting down water cooling towers.

W. J. Merwin

Welding

Anderson, O. F. PROGRESSIVE WELDING. *Gas* **25**, 26-27 (1949) *August.*

A diagram and pictures are presented of welding of pipe in 500 ft sections. All operations—welding, testing, swabbing—can be performed at a single central location, thereby saving time and money. Pipe is stockpiled on skids at 500 ft intervals and is unloaded from trucks by ramps or skids. As each length of pipe is welded it is pushed forward, the pipe sliding on ball bearing rollers. It is claimed that labor costs can be reduced by about 50% by this method.

W. J. Merwin

The following articles, which have not been abstracted, are also called to your attention:

Nelson, W. L. COSTIMATING PIPE AND TUBING. *Oil Gas J.* **48**, 65 (1949) *August* 4.

Nelson, W. L. COSTIMATING CHEMICAL EQUIPMENT-I. *Oil Gas J.* **48**, 109 (1949) *August* 11.

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Pieters, J. A. L. CONTINUOUSLY OPERATING FURNACE FOR THE DISTILLATION OF FUEL. p. 237.

12. MATERIALS OF CONSTRUCTION

Corrosion

Dravnieks, A. and McDonald, H. J. GAS-METAL REACTIONS. PART I. *Iron Age* **164**, 78-82 (1949) *August* 25.

The authors discuss an investigation of the gas-metal reactions where the reaction products are non-volatile and film forming on the metal surface. Corrosive action of various gases often neutralizes the ability of a metal to withstand high temperatures. The importance of phase changes in the scaling reactions are emphasized. The use of X-ray, electron diffraction, radioactive tracer, and electrical methods are described and techniques for measuring reaction rates are discussed.

B. E. Hunt

Dravnieks, A. and McDonald, H. J. GAS-METAL REACTIONS. PART II. *Iron Age* **164**, 84-86 (1949) *September* 1.

The techniques for measuring gas-metal reaction rates discussed in Part I are described more fully. The limitations and advantages of the various methods available are appraised. The micro balance method and gas-volumetric methods are believed to be the most versatile.

B. E. Hunt

Mayne, J. E. O. and Evans, U. R. THE PRACTICAL PROBLEMS OF CORROSION. PART XIII. THE PAINTING OF WET STEEL SURFACES. *J. Soc. Chem. Ind.* (British) **68**, 212-215 (1949) *July*.

Atmospheric tests on the corrosion of painted steel surfaces exposed at Cambridge in 1942 are reported. Two types of steel, having four surface conditions—scale intact, pickled, weathered, and pickled and weathered—were painted in two conditions, dry and carrying a film of water. Straight oil paints and emulsion paints containing boiled linseed oil, refined linseed oil, or medium stand oil and having red lead, iron oxide, or zinc dust as pigments were used. The results show no difference between wet and dry surface applications. As was expected, the coating life was longer if applied to freshly pickled surfaces and red lead proved to be the most satisfactory pigment.

B. E. Hunt

Meyer, W. B. CORROSION RESISTANCE OF SPRAYED METAL COATINGS. *Corrosion* **5**, 282-287 (1949) *September*.

Iron or steel metallized by spraying with a coat of either pure zinc or aluminum is satisfactorily protected from corrosion. Under a certain minimum thickness of metal the porosity of the laminar coating is not an important consideration. The composition of the sprayed coating is not appreciably different from that of the original wire.

B. E. Hunt

Refractories

Hicks, J. C. and Davies, B. HIGH TEMPERATURE PROPERTIES OF MAGNESIA REFRACTORIES. *Iron Age* **164**, 98-105, 157-158 (1949) *August* 11.

Subjecting a high purity magnesia refractory to a temperature of 3800°F for an extended length of time produced marked changes in chemical and mineralogical character and in physical and thermal properties. The test brick, with a temperature gradient of 3800° to 1000°F revealed practically complete recrystallization and tremendous grain growth of magnesia in the hot end. Chemical analyses showed that a diffusion of the calcium, silicon and boron oxides had taken place from the hot end to the lower temperature end. There was a change in physical properties of different sections of the brick, the cold strength of the hottest portion of the brick being much higher than the original brick, the cold strength falling off in sections farther from the hot end. Sections showing extensive recrystallization and diffusion of low melting point minerals had improved load bearing capacity at high temperature while sections that contained the diffused minerals and showed recrystallization to a lesser extent had poorer load-bearing capacity than the unused brick. Spalling loss was greatest where recrystallization was greatest. The authors conclude that high purity magnesia refractories should be serviceable under carefully controlled conditions to temperatures as high as 3800°F.

E. J. Pyricioch

13. NEW BOOKS

Fluid Mechanics

Binder, R. C. FLUID MECHANICS. New York, Prentice-Hall, Inc., 1949.

This is an introductory text book in fluid mechanics covering statics, kinematics and dynamics of fluid systems, both compressible and incompressible. Topics treated include pressure measurement, flow laws, dimensional analysis, flow measurement, pumps and fluid couplings.

J. D. Parent

SERVICE TO READERS

Bibliographies and Literature Searches

The library will prepare bibliographies and make literature searches on a cost basis plus a fixed service charge. A comprehensive statement outlining the problem in detail must be presented with the request.

Photocopies

The library will furnish photostatic or microfilm copies of articles abstracted in GAS ABSTRACTS at cost.

Abstracts on Cards

Copies of any abstract in GAS ABSTRACTS on 5 x 8 cards will be supplied on request.

Periodicals Abstracted for GAS ABSTRACTS

American Gas Association Monthly
American Gas Journal
American Petroleum Institute Quarterly
American Society for Testing Materials Bulletin
Analytical Chemistry
Bituminous Coal Research
Blast Furnace and Steel Plant
British Abstracts
British Coal Utilization Research Association Monthly Bulletin
Butane-Propane News
California Oil World
Canadian Chemistry and Process Industries
Canadian Gas Journal
Canadian Journal of Research
Ceramic Age
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Industries
Chemical Reviews
Chemistry and Industry
Coke and Gas
Combustion
Compressed Air
Construction Methods
Corrosion
Corrosion and Material Protection
Engineers' Digest
Fuel Abstracts
Fuel in Science and Practice
Gas
Gas Age
Gas and Oil Power
Gas Appliance Merchandising
Gas Journal
Gas Research Board Publications
Gas Times
Gas World
Heating and Ventilating
Heating, Piping and Air Conditioning
Industrial and Engineering Chemistry
Industrial Gas
Industrial Heating
Institution of Gas Engineers: Bulletins, Communications and Transactions
Instruments
Iron Age
Journal of the American Chemical Society
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Education
Journal of Chemical Physics
Journal of the Chemical Society (London)
Journal of the Institute Fuel
Journal of the Institute of Petroleum
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical and Colloid Chemistry
Journal of Research National Bureau of Standards
Journal of the Society of Chemical Industry
LP Gas
Materials and Methods
Mechanical Engineering
National Gas Bulletin of Australia
National Petroleum News
Nature
Nucleonics
Official Gazette of the U.S. Patent Office
Oil and Gas Journal
Operating Engineer
Petroleum
Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Pipe Line News
Power
Power Generation
Public Utilities Fortnightly
Refrigerating Engineering
Southern Power and Industry
Steel
Transactions American Society of Mechanical Engineers
Transactions of the Faraday Society
U.S. Bureau of Mines Bulletins, Information Circulars, Reports of Investigations and Technical Papers
World Oil